Forecasting regional labour market developments by occupation and education

Forecasting regional labour market developments by occupation and education ([25])

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The paper presents a model that covers the whole regional labour market with regard to detailed occupational groups and types of education. In drawing up the regional labour-market forecasts an approach was chosen in which the regional forecasts of employment growth per sector of industry, the age composition and the participation rates at regional level and the regional distribution of working youngsters with a particular type of education are important input. The advantages of this approach are consistency of national with regional forecasting of the labour market, and allowance for interaction between different segments of the regional labour market. Another advantage is that in spite of data constraints a fairly high level of disaggregation by occupation and education can be achieved at regional level. However, the regional model hardly deals with changes in the mobility flows of workers between regions. The relevance of these flows is dependent on to what extent labour-market developments in the specific region respond to mismatches between occupation and education (gaps) in other regions. Further research is required to incorporate these adjustment processes into the regional forecasting model.

1. Introduction

For the Netherlands the Research Centre for Education and the Labour Market (ROA) biennially publishes the report *The labour market by education and occupation to 200x* ([26]), which includes analyses of expected labour-market developments in the light of particular policy issues. Since the matching problems between labour supply and demand can be regional in nature, ROA conducts forecasts for three provinces of the Netherlands (Limburg, Gelderland and Overijssel). The regional labour-market forecasting by occupation and education is based on the methodology used to forecast national labour-market developments. An advantage of this approach is that the forecasts for the regional demand and supply are consistent with the national forecasts.

The general forecasting model for the whole labour market and data from national and regional sources are combined to serve two main functions of labour-market forecasts: policy and information (van Eijs, 1994). The policy function refers to the usefulness of labour-market forecasts for policy-makers at ministries, public employment services and employment agencies, employers' organisations, unions and educational organisations. Expected labour-market developments in broad occupational classes or educational categories can be found in the above-mentioned report. By considering the main future trends of the labour market, policy-

([25]) This is an extended version of the paper which will be published in the book *A survey of spatial-economic planning models in the Netherlands. Theory, application and evaluation.* Edited by F. van Oort, L. van Wissen and M. Thissen.

([26]) See for example ROA, 1995, 2001, 2003abcd and Cörvers, et al., 2002.

makers can propose required changes in the educational infrastructure, or underpin strategic management decisions on human resource policies. Forecasts at national and regional levels that focus on the macroeconomic or industry level – as usually is the case – do not allow detection of changes in the occupational mix within sectors of industry or the continuous upgrading of the skill level within many occupations. Further, since the forecasting model covers the whole labour market, it can account for interaction between different segments of the labour market. Partial analyses of the labour market often fail to include these interactions ([27]).

Information originally focused on vocational and career guidance. This improves the functioning of the labour market, since individuals are more able to adjust their human capital investment decisions to labour-market prospects of types of education (Borghans, 1993). The National Careers Guidance Information Centre (LDC) ([28]) incorporates ROA's labour-market information in various products for vocational and educational guidance. Firms and labour-market agencies may also use labour-market forecasts as 'early warnings' on future recruitment problems and to outline human resources policies or design training programmes. In other countries comparable occupational forecasts are published, for example, by the Bureau of Labor Statistics in the US and ESRI in Ireland (for a review of OECD countries see Neugart and Schömann, 2002). All these models assume labour-market imbalances exist because of market imperfections. Providing individuals with information about future labour demand and supply developments for different occupational groups and types of education may reduce cobweb-type ups and downs.

Labour-market information for individual purposes usually requires much more detail than that for policy-makers. Therefore labour-market information provides a detailed insight into the current and future labour-market position of 104 types of education and 127 occupational groups. The ROA information system covers the whole spectrum of occupational groups and types of education on the labour market and is designed to cater to both. For consistency between aggregated labour-market information (e.g. employment trends at sector level, increase in the level of education) and detailed information, it is important to use both a fitting general forecasting model and national databases which distinguish between the various occupational groups and types of education.

This chapter deals with the forecasting model of the Dutch labour market and its regions developed by ROA. Section 2 discusses some organisational issues on national and regional labour-market forecasting. Section 3 discusses the basic principles underlying ROA's labour-market forecasting. Subsequently the most important parts of the forecasting model are discussed, i.e. expansion demand, replacement demand, inflow of school-leavers onto the labour market, and the labour-market gap indicator. Section 4 presents regional labour-market forecasts for the province of Gelderland. Section 5 draws some conclusions.

([27]) For example, analysis of the labour market for engineers should include manufacturing industry developments as well as other sectors of industry.

([28]) Available from Internet: www.ldc.nl [cited 27.10.2005].

2. Organising national and regional projects on labour-market forecasting

The national forecasting project in the Netherlands calculates labour-market developments every two years. Forecasts are given for a period of five years. These forecasts are produced for policy-makers in ministries and other governmental, semi-governmental and other organisations involved in labour-market issues and especially in the match between education and the labour market. There is also a digitised dataset available to individuals, such as labour-market data on vocational guidance, training programmes and job search. During the year the forecasts are produced, the forecasting models use new insights into the functioning of the labour market. The models are recalculated using updated input data. Another year is spent on preparing the specific topics presented in the different chapters of the report, evaluating forecasts made in the past, and developing new labour-market indicators and submodels.

The research is carried out by a team of about 10 researchers (about four FTE per year). There is an advisory committee of professional experts headed by an independent chairman (university professor). Financial matters are discussed and negotiated in a committee of financing partners. The project was originally (1985) financed on a five-year basis and then on a three-year basis. Today, the budget and activity plan are negotiated every year, although there is a 'gentleman's agreement' to continue the project for several years to come. The budget is split into two parts: a basic part and a supplementary part consisting of delivering information to specific users. The basic part is financed by the ministries of education and agriculture, the Centre for Work and Income (CWI), National Careers Guidance Information Centre, temporary employment agency (Randstad), and some institutes with specific tasks in education and the labour market. Additional activities are financed by an institute producing and publishing information for students' choices and by the Centre for Work and Income. All labour-market information is available on request. However, to prevent free riding, big clients (e.g. professional or trade organisations, large firms) have to pay for labour-market information to cover extensive research. Small requests for labour-market information from, for example, journalists is provided free of charge.

Organising regional labour-market projects differs somewhat across regions. There always is an advisory committee of local experts, representing (semi-) governmental bodies, schools, trade organisations, employment agencies, etc. When conducting research ROA often works with the research institute of the region in question. At regional level a digitised dataset is available – free of charge – through, for example, the website of a particular province. Provinces in the Netherlands are usually the most important partners to initiate and finance projects on regional labour-market forecasting. However, sometimes the Public Employment Service (CWI) finances them, and in some regions local educational institutions and trade organisations, municipalities and regional platforms for labour-market policy are willing to pay for the forecasting project. The continuity of a labour-market project in a particular region is less guaranteed, and depends on the regional agenda and evolving policy priorities.

3. Basic principles and structure of the forecasting model ([29])

In the past, it was thought that coordination of the education system and the labour market could be solved by planning. One well-known approach was the 'manpower requirement model' as applied, for example, by Parnes (1962), who developed a manpower planning model based on the input-output structure of the economy. Various methodological and fundamental objections have been made to this approach. Methodological objections focus particularly on fixed coefficients, used in the forecasting models to translate economic development into changes in employment differentiated by training and occupation, and on its mechanical concept of labour-market functioning, in which there is no place for substitution and other adjustment processes (Blaug, 1967). The fundamental objections are that future developments are not sufficiently predictable, and that an exclusive relationship between job requirements and training is assumed without adequate justification.

These objections and lack of sufficient statistical data for estimating forecasting models, led to rejection of the planning concept. A flexible approach to education was advocated, which would enable an adequate response to uncertain future developments. According to the latter concept, initial training courses should be broadened so each could lead to a broad range of occupations. Any discrepancies between specific and mutable job demands, and qualifications of workers would have to be dealt with by short training courses and on-the-job training.

Further, it was no longer thought that a policy of direct intervention was required to ensure correspondence of the education system to the labour market, but rather that providing adequate information would make the labour market more transparent for those choosing a course of study or others investing in education. This transparency would make the supply of labour more responsive to changes on the labour market. Labour-market forecasts also give firms an indication of future labour recruitment problems for various skill categories, enabling them to anticipate future shortages, and provide internal training and outflow reduction policies for categories of workers for which future shortages are forecast. This development is evident in the completely changed role of manpower forecasting in various countries where occupational and/or educational forecasts are still made (Hughes, 1993; Heijke, 1994; OECD, 1994; Heijke and Borghans, 1998; Neugart and Schömann, 2002).

Several basic principles are considered when compiling these highly differentiated forecasts. These principles counter the more fundamental and methodological criticisms of initial manpower planning approaches and are listed below. The same methodological issues apply to regional forecasting models of labour demand and supply. However, when forecasting regional labour demand and supply some additional issues and constraints are important:

(a) forecasts are limited to the medium term, a period of five years. In this horizon changes on the labour market are less uncertain than in the long term ([30]), where uncertain results of substitution, geographical mobility and other adjustment processes can be decisive, in

([29]) Some parts of this section were taken from Cörvers et al. (2002). For the regional dimension of the ROA forecasting model see also Berendsen et al. (1993).

([30]) Also pupils and students participating in educational courses with a maximum duration of five years, due to which their inflow onto the labour market in the medium term can be predicted relatively easily (although predictions on drop-outs and flows within the educational system are also important).

particular where discrepancies between demand and supply may be extremely large. On a smaller scale of analysis, for example in the 12 provinces in the Netherlands, the uncertainties are larger due to the great impact of the closure or establishment of a big firm in the region;

(b) instead of fixed coefficients for the occupational and skills structure of employment, explanatory models are used to describe the changes in both structures over time. Some preliminary analyses show that the national occupational and skills structure of employment within sectors of industry is very similar to the employment structure in many regions. Therefore trends in the employment structure within sectors of industry are similar and can be used to forecast regional employment growth. Moreover, differentiation of the regional employment structure by occupation and education is not possible for all labour-market segments due to the relatively small sample sizes at regional level in the labour force survey (LFS);

(c) the theoretical framework, which underlies forecasting models, incorporates both *ex ante* and *ex post* substitution processes in forecasts of labour-market situations for various types of education. Ex ante substitution refers to demand-led substitution between types of education due, for example, to the upgrading of skill requirements for a particular occupation, whereas *ex post* substitution refers to shifts in the educational structure of employment in an occupation as a result of the initial gaps between demand and supply of various types of education (e.g. Borghans and Heijke, 1996; Cörvers and Heijke, 2003). In the regional forecasting model interaction between regional labour markets is (and perhaps more) important, in particular when forecasts are made for administratively-bound areas such as provinces (see Hensen and Cörvers, 2003). This implies that both substitution processes between types of education within regions and changes in commuting (or migration) flows between regions can solve the discrepancies between supply and demand to some extent. However, these adjustments between supply and demand are not costless;

(d) no detailed comparisons of demand and supply are made for each forecasting year, but forecasts themselves are limited to general indicators of the relationship between demand and supply for categories of education over the whole forecast period. Information intended as guidance for students is limited to a qualitative description of the labour-market prospects of these training categories, on a scale from 'good' to 'poor'. This requires education categories to be carefully constructed, so that the variation in labour-market prospects within each category is as small as possible ([31]). At regional and national levels the same classifications by occupation and education and the same characterisations of labour-market prospects are used;

(e) it is important to make as much use as possible of any information on the future growth of employment, flows between work and inactivity, and flows from the education system onto the labour market. In the Netherlands this applies in particular to changes in employment in the various sectors of industry, which are taken from the Netherlands Bureau for Economic Policy Analysis (*Centraal Planbureau,* CPB), and to flows from the education system onto the labour market, which are taken from forecasts made by the Ministry of Education, Culture and Science. By using these, we ensure labour-market

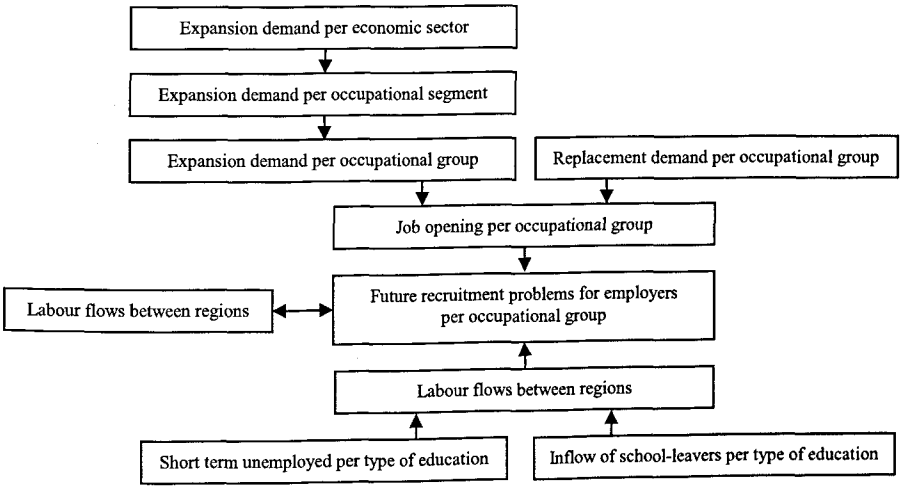
([31]) For a description of the way in which ROA has defined the types of education that it differentiates, see Heijke et al. (2003).

forecasts are consistent with forecasts that provide the basis for policy decisions on important social and economic issues ([32]);

(f) the uncertainties associated with labour-market forecasts, are to some extent met by mapping the labour-market risks that a particular choice of training may exhibit. Statistical indicators have been developed as a supplement to forecasting the probability of finding an attractive job. The indicators give insight into, for example, the opportunities that a type of education offers for switching occupations, and the sensitivity of the occupations relevant for a particular type of education to cyclical fluctuations (Dekker et al., 1990). Preliminary analyses show these indicators do not differ much between regions;

(g) the national forecasts made are evaluated periodically at the end of the forecasting period (see e.g. Borghans et al., 1994; Smits and Diephuis, 2001). This evaluation includes an empirical evaluation of the forecasts made by all submodels and the resulting labour-market signals provided for students and firms, and a survey of the methodology, describing the strong and weak points of the models and possible improvements and extensions. The regional labour-market forecasts have not been evaluated so far.

Figure 1: The general forecasting model



3.1. Structure of the labour-market forecasting model

Figure 1 gives a general description of flows on the labour market. A distinction is made between demand resulting from future changes in employment levels – expansion demand – and demand due to retirement and occupational mobility – replacement demand. The sum of expansion and replacement demand equals the expected number of job openings. A distinction is also made between supply from the inflow of school-leavers and the short-term unemployed. When looking at expected future labour demand and supply discrepancies on the

([32]) See Cörvers (2003) for a discussion of this so-called top-down approach.

labour market by occupation or education arise. These discrepancies can be seen through an indicator of the future labour market situation (IFLM), which shows the future labour-market prospects for school-leavers with a particular type of education or the future recruitment problems of employers to find personnel for a particular occupation. In the figure the comparison between demand and supply is presented for occupational groups. Through the IFLM employers can foresee to what extent it will be possible to recruit personnel with the required qualifications for particular occupations.

3.2. Expansion demand

The national employment projections by sector of industry, based on the Athena model of CPB, are the starting point for the forecasts. The Athena model is a multisector model of the Dutch economy (CPB, 1990), which distinguishes about 15 sectors ([33]). However, CPB does not make regional forecasts of employment growth by sector. Therefore an alternative source of forecasts is required by which national and regional forecasts by sector are compiled according to a similar methodology. The regional forecasts of employment growth by sector are derived from forecasts made by the provinces themselves or other institutes (Ecorys NEI, TNO). However, the national CPB employment forecasts are often used as input when compiling these regional employment forecasts. Considering that particular occupational classes within economic sectors may grow more rapidly than others, we translate the forecasted employment growth of economic sectors into the expansion demand per occupational class (Cörvers et al., 2002; 2004). In turn, the implications of the predicted growth in the various occupational classes for the expansion demand for each type of education are determined. Regional forecasts of expansion demand are determined by using these national forecasts. The expected national changes in the occupational and educational employment structure are projected on the professional and training structure of employment of the region concerned ([34]).

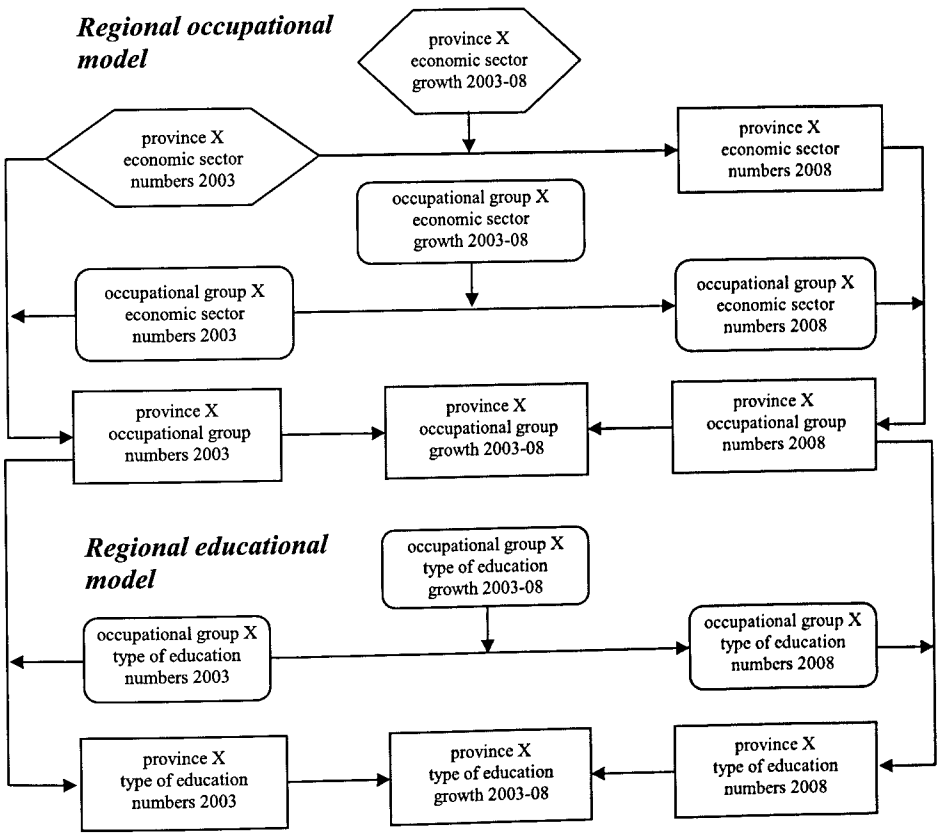
Data on the regional employment structure are drawn from the LFS of Statistics Netherlands. Forecasts are only made for occupational groups or types of education with at least 2 500 persons (average of two years) employed in the region in question. This restriction is set by Statistics Netherlands to prevent publication of figures from the LFS with too broad confidence intervals. Thus, this number can be regarded as the minimum size of occupational groups and types of education for which reliable regional labour-market forecasts can be made.

The model of expansion demand is illustrated in Figure 2. Various shapes have been used for the boxes in Figure 2. A rectangle with rounded corners shows the results (or interim results) from estimating the national forecasting model. Additional data required for forecasting the regional expansion demand are marked by a hexagon. Results of the regional model are shown in a rectangle. Shaded rectangles represent final forecasting results of changes in provincial employment by occupational group and type of education.

([33]) The classification and number of sectors distinguished in the Athena model of CPB varied over time.

([34]) A similar approach was followed for regional occupational forecasts in the UK (Lindley and Wilson, 1991).

Figure 2: Methodology of regional expansion demand



National employment forecasts per occupational group are derived as follows ([35]). Starting from the CPB forecasts of employment by sector, a two-step model is estimated to explain the occupational structure of sectors. The changes in employment levels per economic sector are first translated into employment changes for 43 occupational segments by using a model with explanatory variables ([36]). Changes in the employment structure are estimated based on the LFS data from 1988-2002. Because the available time series is rather short, a random coefficient model has been used ([37]).

([35]) National forecasts of expansion demand per type of education are not discussed here. The methodology of these forecasts includes shifts in the employment structure of skill categories (upgrading) within an occupational group due to technological and organisational developments, as well as the substitution processes that result from discrepancies between labour demand and supply and cause additional shifts in demand as employers adjust their desires in accordance with the availability of workers (see Borghans and Heijke, 1996; Cörvers and Heijke, 2003).

([36]) In the latest occupational model of expansion demand (Dupuy and Cörvers, 2003) the relevance of explanatory sector variables such as value added, capital investment and R&D expenditure, follows directly from a microeconomic model for the occupational structure of sectors. In this model additional variables of capital-skill and skill-biased technological change are considered.

([37]) Borghans and Heijke (1994) provide a detailed description of this model.

3.3. Replacement demand

The demand for labour also consists of replacement demand, which arises when workers retire, leave the labour force under an early retirement scheme or due to work disability, withdraw from the labour market temporarily, or switch to another occupation, etc. However, replacement demand only occurs if the departure of an employee actually leads to a vacancy for a new entrant. If the departure of a worker is taken as an opportunity to cut employment levels, no replacement demand results. There is an important difference between replacement demand per occupational class and per type of education, because occupational mobility has an influence on replacement demand per occupational class, but not on replacement demand per type of education. Switching occupations has no effect on the educational structure of employment. On the other hand, when workers complete part-time studies for a higher level or a different qualification, it produces an outflow of workers to another educational category (type of education). In this case replacement demand arises in the educational category under which the worker's previous education was counted.

The first step in modelling future replacement demand per occupational group ([38]) is to describe inflow and outflow patterns by occupational group over a historical period. Because there are no appropriate data for mobility flows on the labour market, stock data are used. By using the cohort components method cohort-change rates based on the number of persons of the same birth cohort who were employed at two different times are calculated (Shryock and Siegel, 1980).

The second step is to translate these inflow and outflow percentages into replacement demand by occupational group. For occupational groups with an increase in employment in the period (t-1,t), replacement demand is equal to total net outflow during this period. However, for occupational groups which faced a decrease in employment, not all vacancies due to the outflow of workers will have been filled. Therefore, replacement demand for these occupational groups equals the number of vacancies that were actually refilled, that is, the total inflow of workers in the occupational group. A random coefficient model is estimated in which the net inflow or outflow ratios are explained based on the average inflow or outflow from the total working population on the one hand and the occupation-specific deviations per age-gender group on the other (Willems, 1999). This approach guarantees that the sum of the net flows among occupations corresponds to the total inflow or outflow.

The third step is to project the historically measured net replacement demand rates per age-gender group for a particular occupational group onto the age-gender structure of workers at the beginning of the forecasting period. Further, the historically observed cohort change rates are corrected for business cycle effects and for expected changes in participation rates (for more details see Willems and de Grip, 1993). Future replacement demand is determined in the same way as historical replacement demand. For occupational groups with an expected increase in employment, replacement demand equals net outflow. For occupational groups for which a decrease in employment is expected, replacement demand is equal to the total net inflow.

The replacement demand for Gelderland (Section 4) is derived by using the official sources of the province of Gelderland on the structure of the labour force by gender and age. Corrections

([38]) A similar method is used to determine the replacement demand per type of education.

for changes in the participation rate are determined by using these regional data as well. To forecast replacement demand the same inflow and outflow rates are used (by gender and age class, and by occupation and education) as those estimated for the Netherlands. It is assumed these rates do not differ much between regions, since, for example, retirement schemes for sectors of industry or occupations are often settled at national level. Further, the occupational structure of the working population is drawn from the LFS. A RAS procedure ([39]) is used to estimate the matrix of occupation by age-gender group. Total regional replacement demand per occupational group can be derived by projecting the corrected net inflow and outflow ratios on this matrix.

3.4. Inflow of school-leavers onto the labour market

Forecasts of the flows of school-leavers entering the labour market match the *Referentieramingen* (Reference forecasts, OCW, 2001) compiled by the Ministry of Education, Culture and Science for courses in the 'regular' (full-time initial) education system. ROA disaggregates these forecasts by using supplementary data from education matrices of Statistics Netherlands and its own school-leavers information. Supplementary data from Statistics Netherlands are also used to estimate the effects of further (vocational) education on the flows entering the labour market. Besides those leaving school with a qualification, the reference forecasts cover students who end their studies without a certificate. With the help of education matrices, these school-leavers can be reassigned to any preliminary course from which they have obtained a certificate.

A forecast is also made of the flow from post-initial training onto the labour market. This flow indicates the effects of lifelong learning on the educational structure of labour supply. Data on the inflow of 'newcomers' to the labour market from post-initial training are derived from the LFS. Due to data restriction it is assumed that in the forecasting period the proportion of workers with a particular educational background that completes a post-initial training course giving them another educational background is the same as in the latest year for which data on the participation in post-initial training are available.

The national inflow of school-leavers with a particular type of education onto the labour market is distributed over the regions by the shares of working youngsters (until 30 years old) living in the different regions (provinces of the Netherlands). By implicitly allowing for historical migration flows of young workers between regions, we are able to forecast the inflow of school-leavers onto the regional labour market. However, gaps between supply and demand in particular labour segments within regions may change the direction of these migration flows.

3.5. Labour market gap indicator

By matching labour demand with supply, an IFLM situation can be constructed. This indicator of labour-market prospects is constructed for each occupational group and type of education. If the indicator of the future labour-market recruitment problems for employers has the value of 1, employers are not constrained by limited supply of particular types of education in their recruitment policy. The indicator represents the extent to which labour supply meets demand

([39]) RAS procedure is a biproportional method of a matrix adjustment where R = row-adjustment factors, A = input-output matrix, and S = column-adjustment factors.

per occupational group. In particular, the indicator measures the chances employers have to achieve the desired educational composition of the workforce within occupational groups at the end of the forecasting period (Cörvers et al., 2004). The smaller the indicator is, the larger the recruitment problems for employers. The indicator of the future labour-market situation is translated into a 'qualitative characterisation' of expected future recruitment problems for employers on a five-point scale: none, almost none, some, serious and very serious. Such a qualitative characterisation in quite broad terms suffices for various purposes, including recruitment policies, labour-market exchange, training policies, and vocational counselling and career guidance. Further, it prevents much significance being attached to the exact numbers of shortages or surpluses.

The forecasts and the labour-market gap indicator (IFLM) give an indication of the direction of the change in labour flows between regions required to smooth discrepancies between labour demand and supply. Although potential changes in inter-regional mobility flows are not considered in the basic regional labour-market model, these changes may be important as a labour-market adjustment mechanism. However, local labour markets may be isolated by infrastructural barriers that prevent the free movement of labour between regions. Shortages of specific types of workers in a local labour market can persist if these barriers are too high.

4. Application of the regional labour-market forecasting model

This section will present the forecasting results for the province of Gelderland, one of the 12 provinces of the Netherlands. Gelderland is situated in the middle and eastern part of the Netherlands, between the province of Utrecht and Germany. The capital city is Arnhem and other important cities are Nijmegen and Apeldoorn. The labour force of Gelderland consists of about 845 000 workers, 12 % of the Dutch working population. Relative to the Netherlands, many people in Gelderland work in the food and beverage industry, metal and electronics, rubber and plastics and construction. Relatively few are employed in energy, chemicals and transport, storage and communication.

4.1. Forecasting results for the province of Gelderland

In Table 1 the forecasting results of 11 occupational classes are presented for the period between 2003 and 2008 (ROA, 2004). These 11 occupational classes are aggregates of 127 occupational groups, for which the most detailed forecasts are available. The classification of occupational groups is based on the three-digit international standard classification of occupations (ISCO). Forecasts may vary significantly for different occupational groups within one occupational class, in particular between occupational groups with high job levels and those with low job levels.

The total percentage of job openings during the five-year period from 2003 to 2008 is expected to be 20 % of the total number of employed in 2002. Note that total replacement demand is much larger than total expansion demand ([40]). The largest number of job openings

([40]) The outflow of workers from a particular occupational group only contributes to the number of job openings when these workers are really replaced. Thus, the replacement demand model accounts for the foregone job

as a percentage of occupational employment in 2002 can be found in public security and safety, education and the cultural occupations (e.g. interpreters, library assistants, artists, clergymen and journalists). The last two occupational classes also exhibit the largest replacement demand. On the contrary, very low replacement demand is expected for ICT occupations. These differences in replacement demand are to an important extent related to differences in age composition between occupations. The strongly growing employment in ICT occupations has attracted many young people. For these occupations expansion demand is still expected to be the largest of all occupational classes. Employment in agricultural occupations is expected to decrease further during the coming years. For technical and industrial occupations, transport, sociocultural occupations (e.g. personnel officers, personnel managers, welfare workers, researchers) and commercial and administrative occupations, expansion demand is also expected to be negative.

The mismatch between labour supply and demand is indicated by the IFLM. As discussed before, the indicator has the maximum value of 1 if employers are not constrained by limited supply of school-leavers for particular types of education. The smaller the indicator is, the bigger the recruitment problems. From Table 1 it follows that employers searching for graduates qualified to work as teachers in the educational sector will be confronted with very serious recruitment problems. The number of job openings, mainly caused by replacement demand, cannot be easily refilled, as the inflow of school-leavers into educational occupations is too low. Despite the relatively large number of job openings in the public security and safety occupations, the inflow of school-leavers is large enough to prevent serious recruitment problems for employers. However, employers may expect serious recruitment problems in cultural, technical and industrial occupations. For the public security and safety occupations the number of job openings as a percentage of occupational employments is relatively large, whereas for the sociocultural, technical and industrial occupations this percentage is on average. Recruitment problems in the technical and industrial occupations in Gelderland are mainly due to the relatively low inflow of technically educated school-leavers onto the labour market. These recruitment problems are on average much larger than in other parts of the Netherlands. On the contrary, recruitment problems for sociocultural occupations are much smaller in Gelderland than elsewhere in the Netherlands.

openings due to an expected employment decline. Therefore, in our model negative expansion demand does not reduce the number of job openings (Cörvers et al., 2004). As a result the number of job openings only equals the sum of expansion and replacement demand for a particular occupational class if expansion demand is positive for all occupational groups within that class.

Table 1: Expected future expansion demand, replacement demand, job openings, and IFLM situation per occupational class for employers in 2008, as percentage of occupational employment in 2002

Occupational class	Expansion demand % Gelderland	Replacement demand % Gelderland	Job openings % Gelderland	IFLM Gelderland	Characteristic of expected recruitment problems in 2008	
					Gelderland	Netherlands
Educational occupations	10	21	32	0.89	Very serious	Serious
Cultural occupations	9	18	28	0.90	Serious	Some
Agricultural occupations	-8	18	18	0.96	Almost none	None
Technical and industrial occupations	-3	18	20	0.91	Serious	Almost none
Transport occupations	-3	13	15	0.96	Almost none	None
Medical and paramedical occupations	5	17	23	0.92	Some	Serious
Commercial and admin. occupations	0	14	16	0.95	Almost none	Some
ICT occupations	11	9	21	0.93	Some	Some
Sociocultural occupations	-1	15	18	0.95	Almost none	Serious
Care and service occupations	6	16	23	0.97	Almost none	None
Public security and safety occupations	7	25	34	0.92	Some	Serious
Total	1	16	20			

Source: ROA/Province of Gelderland/CPB.

4.2. Commuting flows and the inflow of school-leavers onto the regional labour market

One way to reduce the mismatch between demand and supply in Gelderland is by changing the commuting and migration flows. The supply of labour from other (neighbouring) regional labour markets with fewer mismatches could reduce the mismatches for specific occupational groups in Gelderland, for example in technical and industrial occupations mentioned above. Table 2 gives an impression of the changes in commuting flows and flows of school-leavers onto the regional labour market that are required to bridge the gap between labour supply and demand for the 11 occupational classes. The table shows that to solve shortages in educational occupations in Gelderland, incoming commuting flows should increase by about 170 %. This is not very realistic, particularly since employers are expected to have serious recruitment problems in other parts of the Netherlands. However, for the technical and industry occupations an increase in the incoming commuting flow by only 1 % would meet the expected excess demand. Further,

a decrease of incoming commuters in sociocultural occupations by 14 % would contribute to solving the expected serious recruitment problems in other parts of the Netherlands.

Changes in the inflow of school-leavers onto the labour market could also reduce the mismatches between supply and demand on the regional labour market. School-leavers may choose to work in other occupations as school-leavers of earlier cohorts used to do, or may decide to work (and live) in other regions with better labour-market prospects. The last column of Table 2 shows that the required changes in the inflow of school-leavers are smaller than the required changes in incoming commuting flows for some occupations. For cultural occupations an increase in the inflow of school-leavers from other regions by 22 % would solve the recruitment problems of employers in this occupational class, while commuting flows should increase by 40 % to get the same result.

Table 2: Changes in commuting flows (average 2000-01) required to solve discrepancies between demand and supply per occupational class, as a percentage of the forecast excess demand (2003-08) per occupational class, Gelderland

%

Occupational class	Required change	
	Incoming commuters	Inflow of school-leavers
Educational	172	169
Cultural	40	22
Agricultural	-16	-3
Technical and industrial	1	1
Transport	n.a.	n.a.
Medical and paramedical	n.a.	n.a.
Commercial and administration	-48	-26
ICT	41	42
Sociocultural	-14	-9
Care and service	29	10
Public security and safety	58	123

n.a.: Not available due to too small numbers.
Source: ROA

5. Final remarks

The contribution has discussed the labour market forecasting model developed by ROA, which goes beyond the scope of the traditional manpower requirements approach. The model predicts mismatches between labour supply and demand at regional level in the medium term. The model covers the whole regional labour market for detailed occupational groups and types of education. In drawing up regional labour market forecasts an approach was chosen in which regional forecasts of employment growth per sector of industry, the age composition and participation rates at regional level and the regional distribution of working youngsters with a particular type of education are important input. The advantages of this approach are consistency between national and regional forecasting of the labour market, and interaction between different

segments of the regional labour market. Another advantage is, in spite of data constraints, a fairly high level of disaggregation by occupation, and education can be achieved at regional level. Therefore, forecasts by occupation and education can be useful for both policy-makers, who may use regional forecasts at a more aggregate level, employers who may be interested in the future labour-market situation of particular occupational groups, and schools or youngsters who may want to know the labour-market prospects for particular types of education.

Nevertheless, the region-specific dimensions in the labour market forecasting model of provinces are limited, as forecasting draws heavily on national employment trends by occupation and education, and on national flow ratios of workers in and out of the labour force. We expect that trends in the occupational and skill mix within sectors of industry, such as an increase in white collar at the expense of blue collar jobs, and upgrading skills, do not differ much between similar sectors across regions. Moreover, in- and outflow ratios per age class and gender due to, for example, retirement, parenthood or job mobility are not expected to differ much for similar occupational groups across regions.

Finally, the regional model hardly deals with changes in the geographical mobility of workers that result from regional mismatches between demand and supply on the labour market of the province concerned or of neighbouring regions. The relevance of these mobility flows depends on whether similar labour market segments of neighbouring provinces are interrelated, and thus to what extent labour-market developments in a specific region respond to mismatches between occupation and education (gaps) in other regions. Further research is required to incorporate these adjustment processes into the regional forecasting model.

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